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‘Measure twice, cut once’—revisiting the strength and impact of local planning regulation of housing development in England

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Abstract. There has been growing interest in the impact of land-use regulation and planning on housing development and markets, and a consequent search for quantified measures of their extent and efficacy. Nevertheless, despite the UK having a long-established and comprehensive planning system, this kind of quantitative analysis of system performance has been limited. This paper assembles and reports on a set of local-level measures for England for the late 2000s and assesses their effectiveness in predicting the key flow-of-consents measure and actual housing development. The pattern of restrictiveness is assessed against broad sustainability criteria including urban settlement structure, economic growth potential, and housing affordability and need. We also assess recent changes and the potential impact of a major system change towards more localised planning decision making.

Keywords: planning, housing, restrictiveness measures, localisation, England

1 Introduction

This paper is focused on the seemingly arcane topic of ‘measuring planning’ or, to be more specific, the measurement of the extent of restriction applied by land-use plans and regulation on new housing development in different areas. Measuring and modelling the market impacts of land-use regulation and growth controls has been a significantly growing topic in the US literature (Glaeser and Ward, 2009; Glaeser et al, 2006; 2008; Gyourko et al, 2008; Hilber and Vermeulen, 2010; Malpezzi, 1996; Mayer and Somerville, 2000; Quigley and Raphael, 2005; Saks, 2008; White and Allmendinger, 2003). Yet paradoxically in Britain, with its sixty-five years of comprehensive land-use planning, this topic has been relatively neglected. A paper on this by one of the present authors (Bramley, 1998) was acknowledged by reviewers as ploughing a lonely furrow. Since then, policy interest in housing supply in the UK has exploded (Ball et al, 2010; Barker, 2004; Bramley, 2007; Calcutt, 2007; Griffith, 2011; NHPAU, 2008; OFT, 2008; Stephens, 2011). Yet the state of the art in measuring planning restriction has advanced only haltingly. Therefore, in this paper we self-consciously revisit these issues and present a new snapshot of planning for housing across England in the late 2000s. This draws on several strands of recent and current work, including work on neighbourhood-level housing-market change (Bramley et al, 2008) and the development of a working economic simulation model for the English housing system at subregional levels (Andrew et al, 2009; 2010; Bramley, 2012a). It has also been stimulated by collaboration with colleagues from Australia and elsewhere in investigating ‘planning system performance’ (Gurran et al, 2012).

There are significant differences between planning in the UK and systems operating in other countries. The UK system dating from 1947 entails the ‘nationalisation’ of development

rights and all development is subject to discretionary local decisions to grant or refuse planning permission. These decisions must have regard to operative local plans (known after 2004 as 'Local Development Frameworks' or LDFs) and other material considerations, including (until 2010) Regional Spatial Strategies (RSSs), which contained housing targets. However, the current reforms in England remove the regional tiers and targets and place the onus more strongly on the local level.

The context is obviously one of a relatively small and highly populated country with a well-established (and popular) emphasis on urban containment (Bramley et al, 1995; Hall et al, 1973). In the 1980s and 1990s the system was subject to less rapid growth and development than in some other countries, although in the last ten to fifteen years the level of demographic growth and demand pressures have built up to a higher level with the onset of large-scale net in-migration and the long economic upswing to 2007. This changing context brought housing supply back into the policy frame (Bramley, 2007) and led to the Barker (2004) review of housing supply and subsequent policy measures to promote supply. However, the current reform changes the emphasis within this basket of measures, away from top-down targeting towards more use of incentives in a localised system. At the same time the global financial crisis (GFC) has impacted more severely on the UK, leading to a prolonged downturn in the market and development activity.

In this paper we seek to answer five questions:

- (1) What are the best existing measures of planning or regulatory restriction on new housing development?
- (2) What is the pattern of restriction by type of locality in England, with particular reference to location in the urban–rural hierarchy?
- (3) How 'helpful' is this pattern in terms of the overarching goals of promoting affordability, economic growth, and environmental sustainability?
- (4) How has the pattern changed over time?
- (5) What does the current switch from top-down regional planning targets to 'localised' planning mean for patterns of restriction and likely outcomes?

The title of this paper alludes to the revisiting of a topic previously addressed, but also to the pitfalls of measurement and interpretation which are quite prevalent in this field. Measures are sometimes used in this field because they are readily available, or because they appear to have some 'face validity'. That does not necessarily make them reliable measures of the phenomenon of particular interest, in this instance housing supply potential.

In the first part of this paper we attempt to sift more useful measures from a longer list of candidates, and to draw some distinctions in terms of what (conceptually) we are measuring. We then test which indicators in combination provide the best prediction of the actual supply of planning permissions for new housing. The conclusions from this exercise question some of the measures which have been reported in other literature and which are popular in some approaches to assessing the performance of the planning system. We then go on to look at the application of the most useful combination of measures in terms of geographical patterns, particularly across the urban hierarchy within broad regions, and in terms of relationships with broader key outcomes, as well as at changes over the last decade. In looking forward we make inferences about likely changes under the more 'localised' regime promoted by recent reforms.

2 Review of potential indicators

2.1 General considerations

Although contemporary performance cultures in government seem to place a great emphasis on monitoring and benchmarking the performance of planning authorities, in the UK and some other countries this seems to focus more on procedure and processing than on substantive outputs. There has been growing interest in wider outcomes, such as affordability,

and considerable data are available on this in the UK and elsewhere. However, it is very challenging to link such market outcomes to the actual policies, activities, and outputs of local planning.

In our view the most important measures required, in the UK context, is the amount of land made available through planning for new housing development. In other words, the emphasis should be on quantitative measures of land supply. This is a different emphasis from that found in some of the literature and commentaries, where the concern is more with qualitative outcomes, for example, in terms of design, type, and density mix of new housing, or the broader sustainability of plans, or on the speed of administrative processing of development applications (Ball, 2010). It is also somewhat different from the emphasis in countries with a very different, zoning-based, planning systems.

While the quantitative availability of land which is ready for development is clearly critical to supply in the short term, for the longer term we should be investigating ways of characterising and measuring the potential future supply of land for housing. This requires some more imaginative approaches to measuring physical and environmental constraints and capacities. Within planning, it requires some braver attempts at longer term planning of settlement strategy. There is also a need to collect more systematic data on the extent and cost of planning obligations and on development impact fees being sought or collected (Crook et al, 2010, Crook and Monk, 2011), as these affect development viability, which can be particularly crucial in the current recessionary conditions. However, this issue goes beyond the scope of this paper.

In interpreting these data, we think it is useful to draw a distinction between the ‘planning stance’ of a local authority and the actual amount of land available. Planning stance refers to the policy orientation of the authority: that is, its propensity to support development in a positive way where possible or the reverse, its propensity to resist development where it can. The actual land available reflects the interaction between planning stance and the objective situation in terms of physical and environmental constraints governing the potential amount of land which might be made available. It also reflects the stage in the planning cycle—whether a Local Plan (or LDF) has been updated recently—and the possible imposition of top-down targets such as the former RSS overriding local preferences, as well as the state of demand—where demand has been slack a pool of available land may have built up.

2.2 Measuring planning in the 1990s

Bramley (1998) developed around a dozen measures from a combination of special survey responses, routine administrative data, and GIS analysis, but went on to show that these could be grouped into four main ‘factors’. The most important of these was ‘unconstrained land’, essentially a longer term picture of land potentially available after discounting built-up area, green belt, Areas of Outstanding Natural Beauty, and National Parks. Next in line and moderately important were the Structure Plan ‘provision’ numbers, similar to the more recent RSS targets, and the amounts of land with actual planning permission and sites allocated in Local Plans or by Local Authority (LA) resolutions. Taken together with some market variables, these were the best predictors of key outputs, such as the flow of new planning permissions or new-build completions. They also significantly influenced wider outcomes including house prices, density, and the proportion of flats.

Other measures captured the extent of second tier ‘informal constraints’ (eg, green wedges and buffers), the importance assigned to ‘environmental capacity’, and recent changes in Structure Plan provisions (these require special survey). Also included were the ‘success rate’ of planning applications, although like some of the measures just mentioned this was a less effective predictor [notwithstanding the key role assigned to it in certain other studies such as that of Cheshire and Sheppard (1997; 2002) and the more recent work

by Hilber and Vermeulen (2010)]. The study highlighted that this indicator was partially endogenous in the sense of being influenced by the state of the market. For example, the success rate of planning applications partly reflected demand conditions, with high demand prompting more ‘nonconforming’ applications which inevitably had a lower success rate.

2.3 Measuring planning stance and outputs up to 2009

The more recent work mentioned in the introduction has enabled us to assemble a reasonable set of candidate indicators which can be used in modelling the system and market responses. It is still a mixed and somewhat frustrating picture, because of the limitations of official data collection and inconsistencies over time. Only some measures are available on an annual basis; some are available for chunks of several years taken together; some are only available for one point in time (although some of these, for example, Green Belts, do not vary much over time). Potentially relevant indicators are listed in table 1, showing their definition and the data sources used.

Particular frustration concerns the failure of government to maintain a consistent series of returns on land with outstanding planning permission or of sites allocated in Local Plans or LDFs. Such a dataset was maintained from 1988 to 1997, then discontinued at a critical time. To bridge this gap we use two downloads from a commercial dataset, Emap-Glenigan (<http://www.glenigan.com>), which monitors most major housing planning consents. By using this plus new permissions plus completions data, with dead reckoning and various adjustments, we have constructed an annual series for land with outstanding permission (units capacity), although we recognise that this contains considerable ‘noise’.

There is a figure downloadable from the Department for Communities and Local Government (DCLG) for the percentage of five-year land supply requirement available in each district (permissions plus other commitments phased within five years). By manually extracting the target numbers for each district from all of the last sets of RSSs, we can deduce from this the actual amount of available land (permissions plus allocations or commitments) for one point in time, effectively 2009.

The first group of indicators in table 1 are what can be derived from these efforts, together with the actual number of housing units completed, which is the basic outcome of the system in terms of the supply of new housing. While number of new private completions is a key output (or outcome), the number (or rate) of new social completions is open to different interpretations. It is argued that this may be a reasonable indicator of planning stance, insofar as local authorities which support a higher level of new social housebuilding have a general stance towards new housing which is more positive.

Green Belt is regarded as a relatively hard constraint in the British system, where there has been a long-established presumption against development in the Green Belt which tends to be upheld in planning appeals and strongly supported by LAs and public opinion. This is particularly important because Green Belts tend to be located around major urban areas covering land which would otherwise be a prime target for development.

The proportion of planning applications for housing that are approved may seem to be an obvious measure of planning stance, and has been used as such in several studies including Cheshire and Sheppard (1997; 2002) and Hilber and Vermeulen (2010). However, as the latter found in their econometric analysis, and as was argued in Bramley (1998), this indicator is partially endogenous, tending to be influenced by situations of high demand or lack of up-to-date approved plans, when more nonconforming sites are put forward. Also, the indicator is lumpy in annual data. A partial response to this situation is to take the value averaged over a longer period. However, as we go on to report, even when taking the longer term average this indicator does not perform very well in predicting the flow of new permissions or new-build rates.

Table 1. Data inputs and sources for indicators of housing land supply and planning stance at local authority district (LAD) level.

Item	Definition	Source
Completions (ppcmp) ^a	Number \times year \times LAD by private versus social tenure	Communities and Local Government (CLG) Live Tables
Planning-permissions flow (ppflow) ^a	New planning permissions granted for housing, units \times LAD (% of households)	Estimated from CLG PS2 returns and Emap-Glenigan database of major sites
Planning-permissions stock (lpdopp) ^a	Log of outstanding uncompleted permissions units \times LAD (% of households)	Estimated from former Department of the Environment PS3 returns, Emap-Glenigan database, PS2 returns and CLG completions data
Regional Spatial Strategy (RSS) housing target (rssno)	Annual number of net additions to dwelling stock 2006–26, LAD level	Obtained from published RSS documents
Five-year land supply % of RSS target (pct5yls)	Capacity of developable sites with permission or committed, phased over 1st 5 years, divided by RSS target \times 5	Department of Communities and Local Government (DCLG) Planning Statistics Live Tables
Land available % of households (plav09)	100 \times product of previous two items divided by households	Derived
Green Belt % of land area (pgreenbelt)	Approved Green Belt boundaries, area calculated by GIS, divided by total area of LAD	DCLG Planning Statistics Live Tables
Small sites % share (avsmstshr)	Estimated % of units with planning permission on small sites (<10), LAD level	Estimated from Emap-Glenigan database, and CLG PS2 returns data
Average % of planning applications for major housing approved (avgrantrate)	Average over whole period to 2007, LAD level	Derived from DCLG PS2 returns, as used in Hilber study
% of applications approved in last 4 years (pgrant4ya) ^a	Lagged moving average version of above measure	DCLG PS2 returns
Average decision time for major housing applications (decisweeks4ya) ^a	Time in weeks from application to approval	DCLG planning applications performance statistics
Previously developed land % share (pdl) ^a	% of housing units built on previously developed land (brownfield land), moving average	DCLG and OS Land Use Change Statistics
Net density (netdens2)	Dwellings per hectare of land in residential use, ward level	Census 2001, GLUD (Generalised Land Use Database) from CLG via Neighbourhood Statistics
Sparsity (laspars)	Hectares per person, LAD level	Census 2001
Greenspace (pgreenw)	% of land area ‘greenspace’	GLUD

^aTime varying measure.

The decision time on planning applications is a favourite measure for those focused on process efficiency, and some analysts (eg, Ball, 2010) regard this as a significant indicator of planning stance as well as a cause of cost to the industry and supply inelasticity. While there is a priori logic in these arguments, we find that, in practice, this indicator is not a good predictor of the key outputs we are most interested in.

2.4 Measures of the type of land

The share of small sites in the overall land supply is hypothesised to be a negative factor in terms of supply potential, and this is borne out by the results of modelling of new-build output and planning permissions flow. Small sites can be more difficult to develop, and such sites may be controlled by parties who are less interested in delivering housebuilding numbers than in other considerations such as valuation. Furthermore, where small sites represent a high share of available land this arguably indicates that LAs have not been able or willing to identify larger sites for new urban extensions or new settlements. Finally, small sites were traditionally more associated with smaller local or regional housebuilding firms, a subsector which has declined disproportionately in recent years.

The share of new housing built on previously developed land (PDL, or brownfield land as it is often known) is an indicator which received increasing emphasis in planning policy in England in the late 1990s and early 2000s (Adams and Watkins, 2002). This was the period when ideas about ‘urban renaissance’ [Rodgers Report, DETR (1999)] and sustainability arguments for more compact urban form were in the ascendancy. Targets were set for this indicator, nationally and regionally (DETR, 1998; 2000), and achievement was measured through the system of Land Use Change Statistics (LUCS). The main picture from the data over the last decade and a half has been the sustained increase in urban land share, so this now represents a large majority of new housing land, and the substantial hike in density levels. PDL might be interpreted as an indirect indicator of planning stance, although it will also reflect hard constraints. In practice, as we show below, it does not appear to be a particularly significant predictor of the flow of new permissions.

The final three indicators in table 1 are mainly relevant to the issue of the longer term potential availability of land. Density was used in earlier studies as a rather crude measure of existing built-up areas as a constraint. More recently the Generalised Land Use Database (GLUD), based on Ordnance Survey (OS) Mastermap, has become available. This measures the area of land in a range of categories including the footprints of domestic and nondomestic buildings, domestic gardens, roads, paths, railways, and water bodies. We use the indicator of the percentage of land which is ‘greenspace’, defined very broadly to include farmland and open country as well as open spaces embedded in urban areas. This appears to work as hypothesised as a positive indicator of potential land availability which has a positive impact in models for planning permissions flow or new-build output. However, we recognise that there is still considerable scope for further development of more sophisticated measures of potential land availability, taking account of overlaying land-use categories, characteristics, and designations, location in terms of existing built-up areas, and physical features such as altitude and slope.

Table 2 presents descriptive statistics for all the measures used in this analysis across LA Districts (LADs) in England.

Table 2. Descriptive statistics for variables (Local Authority District level for 2007).

Description	Variable name	Minimum	Maximum	Mean	Standard deviation
Private completions (% of households)	ppcmp	0.00	1.47	0.43	0.27
Planning consents flow (% of households)	pppflow	0.13	5.99	1.37	0.65
Consents flow (3 year average)	pppflow_lav3	0.36	3.92	1.45	0.60
Log consents stock (% of households)	lpdopp_1	-2.23	3.02	0.98	0.55
Predicted log consents stock	prldpopp	0.05	2.58	1.06	0.40
Regional Spatial Strategy target abs	RSSNo	5	4300	846	780
Regional Spatial Strategy target (% of households)	prsstarg	0.25	4.31	0.94	0.48
5 year land supply (% of RSS target)	pct5yls	27.00	300.00	130.60	48.40
Land available (% of households)	plav09	0.89	26.31	5.85	3.26
Green Belt (% of land area)	pgreenbelt	0.00	93.76	22.62	26.68
Small sites share of units	avsmstshare	0.020	1.000	0.222	0.139
Applications approved (% average)	avgrantrate	30.51	99.88	66.70	13.00
Applications approved (4 year average)	pgrant4ya	32.36	99.75	66.73	12.15
Average decision time weeks	decisweeks4ya	8.91	21.00	14.72	1.73
Previously developed land (% of units)	pdl	13.00	100.00	73.95	19.80
Planning stance composition	plgstance4	-1.47	1.45	0.02	0.40
Net dwelling density (dwellings/ha)	netdens2	15.40	315.10	48.00	39.30
Green space (% of land)	pgreenw	7.20	94.40	53.00	20.10
Predicted relative price lag 1	prrelprice_1	0.25	2.40	0.97	0.36
Predicted relative price	prrelprice4	0.26	2.15	0.99	0.36
Unemployment rate (%)	asunem	2.19	9.10	3.79	1.30
Index of Multiple Deprivation Low Income (%)	imdlwinc	2.92	28.57	12.44	5.37
Sentiment majority for development	prmajdevm4	-0.40	0.32	-0.05	0.14
House price: income ratio	hpir	3.47	16.48	7.15	1.82
Job growth (% pa)	wjallgr9806	-4.00	5.75	0.92	1.22

3 Indicator selection and combination

3.1 Combining the indicators

A conventional approach to the construction of a composite index from these measures would be to use factor analysis, as in the Bramley (1998) study, at least to establish whether there is a single or several distinct underlying dimensions in the data. Table 3 shows the result of such an approach, using an initial principal components analysis to select four orthogonal factors and then modifying the factors with a varimax rotation. Four factors were considered sufficient to capture the main underlying dimensions as the eigenvalues for factor 4 were only just above 1.0 and the four factors together accounted for 60% of the variance. This table clearly shows that there is not a single underlying dimension, and that a number of distinct dimensions need to be recognised. The success-rate indicators correlate reasonably with small sites (in factor 1) but not much with the other variables. The stock and flow of permissions are closely related to each other (factor 2), but not to the broader available land indicator which includes allocated sites (reflected in factor 3). This second factor is also moderately correlated with brownfield land. Factor 4 loads positively on social completions and negatively on Green Belt land, and thus clearly captures the urban/working class–suburban/middle class dimension to a considerable degree. Each of these components accounts for between 10% and 20% of the variance and all four together account for just under 60%.

Table 3. Factor analysis of planning indicators for 2007 (factor loadings).

Variable		Factor			
name	description	1	2	3	4
lpdopp_1	log stock outstanding consents (% of households)	0.035	0.808	0.028	0.059
pppflow	flow consents (% of households)	0.024	0.729	0.222	0.014
plav09	land available (% of households)	0.126	0.211	0.761	0.330
avsmstshare	average share small sites	−0.597	0.320	−0.331	0.103
pscmp	social completions (% of households)	−0.137	−0.135	0.210	0.615
avgrantrate	average success rate for planning applications (%)	0.832	0.240	−0.053	−0.071
pdl	brownfield land (% of new housing)	−0.312	−0.497	0.124	−0.310
pgreenbelt	Green Belt (% of area)	−0.046	−0.295	0.132	−0.697
pgrant4ya	success rate of planning applications (%)	0.860	0.019	−0.063	0.066
decisweeks4ya	average decision time (weeks)	0.277	−0.399	0.042	0.307
pct5yls	land available (% of Regional Spatial Strategy target)	−0.076	0.011	0.797	−0.109
	% of variance	18.2	17.3	13.3	10.9
	cumulative %	18.2	35.5	48.8	59.7

3.2 Predictive models

Given the basic character of the UK planning system, with its system of discretionary development control, and the view put forward above about the most useful quantitative measures, we would argue that the best single test of these measures, individually or in combination, is how well they predict the actual flow of new planning permissions for

housing, which itself can be shown to predict the subsequent flow of new completions (Bramley and Leishman, 2005). Therefore, we have revisited the modelling of these relationships and report below the preferred regression model emerging from this, together with some variants. We argue that this provides the best basis for an index of planning stance which can be compared across different types of area, as it is readily interpretable in terms of recognisable units and derived from a transparent and appropriate process. This view is reinforced by the results of the factor analysis, which also help us to interpret the regression findings.

Table 4 shows the best parsimonious model for the flow rate of new planning permissions across LADs in England for 2007, using those variables from the wider set reviewed which appear to be significant or on the margins of statistical significance. The model also includes a small number of market and socioeconomic drivers which we might expect to influence this flow—predicted relative house price level, unemployment, and low-income poverty—and also the one indicator of potential future land supply highlighted (pgreenw:greenspace).

Table 4. Regression model for flow of new planning permissions in 2007 (% of households).

Variable		Coefficient	Standardised coefficient		
name	description	beta	beta	t-statistic	significance
(Constant)		0.005		0.017	0.987
prrelprice_1	predicted relative price	0.132	0.074	1.001	0.318
Asunem	unemployment (% for subregion)	−0.085	−0.172	−2.471	0.014
imdlwinc	low income depivation (%)	0.028	0.232	2.476	0.014
pgreenw	greenspace (%)	0.007	0.203	2.669	0.008
lpdopp_1	log stock outstanding consents (% households lag 1)	0.458	0.392	8.242	0.000
avsmstshare	average share small sites	−0.793	−0.170	−2.957	0.003
pscmp	social completions (% of households)	0.773	0.074	1.640	0.102
avgrantrate	average success rate planning applications (%)	0.004	0.080	1.539	0.125
plav09	land available (% of households)	0.046	0.233	5.285	0.000
Dependent variable	pppflow				
Weight	hhdwgt				
<i>Model summary</i>					
R	0.662				
R ²	0.439				
adjusted R ²	0.424				
standard error estimate	0.500				
<i>ANOVA</i>					
Model	Regression	Residual	Total		
sum of squares	66.712	85.383	152.095		
degrees of freedom	9	342	351		
mean square	7.412	0.250			
F ratio	29.690	Significant F	0.000		

Planning indicators identified in table 1 which were tested but rejected as clearly insignificant or unusable due to multicollinearity have been discarded. (Variable inflation factor statistics indicate no collinearity problem with the model in table 4.)

The model can explain rather less than half the overall variation, but this is ‘par for the course’ in this type of modelling and reflects a degree of noise and lumpiness in the annual data. The equivalent model fitted to data smoothed over three years (2005–07) yields a markedly higher R^2 (0.63 versus 0.43) but similar coefficients [table 5, model (2)].

The standardised coefficients (betas) and the t -statistics indicate that the strongest and most significant effects are associated with the two overlapping measures of outstanding planning permissions (ldopp_1, lagged one year) and the overall land availability derived from the five-year land supply and RSS sources (plav09). The hypothesis of a negative association with small sites is confirmed. The hypothesis of a positive relationship with social completions is supported but on the margins of statistical significance. Given the (negative) association of this variable with Green Belt in factor 4 in table 2, this variable may be picking up this as well. The average success rate of planning applications is also found to be positive but again on the margins of statistical significance. The rather weak performance of this measure can be explained, as discussed above, but we retain it in the model given the wider view that it is important and ought to be considered. For the preferred version of the composite planning-stance indicator we weight the last five variables by their coefficients in this regression model.

It will be noted that the variables *discarded* from the final index include:

- Five-year land supply (%);
- Green Belt land (%);
- Recent approval rate;
- Average decision time;
- PDL.

The factor analysis helps to explain some of these omissions, particularly the first three. The proportion of greenspace in total land area is retained in the model but not treated as part of the planning stance composite, because planning stance is supposed to represent the policy orientation of the LA, not its objective constraints on long-term land availability.

3.3 Robustness of findings

At this point we consider some objections to the model that might be raised, as presented in table 4, which might suggest that it is not robust or in some sense misleading. These are addressed, in part, by testing some variant models, reported in more compressed form in table 5, which shows standardised regression coefficients and significance levels.

The first of these points is that the flow of new consents at local level is subject to considerable *random noise* when looking at only one year. This is addressed through model (2) in table 5, which takes instead the three-year average flow. As noted above, this model has a better fit but with broadly similar coefficients.

The second potential objection is the concern that we are predicting planning permissions from planning permissions—that the variable for stock of consents looks as though it is the same thing as the flow of permissions, so we have a case of *spurious correlation*. We would argue that in practice it is not the same thing. The stock of permissions is the product of a history of previous applications, previous take-up in actual construction, and varying lapse rates. So it is a distinctly different variable. What we are trying to do is predict one key output of planning (new consents) from a number of partial indicators of different aspects of the planning situation and policy in a district. The test is whether it is a good prediction, and therefore whether the component indicators taken together provide a reasonable characterisation of the existing planning stance. It should be noted, nevertheless, that there

Table 5. Comparison of variant models for flow of consents (standardised regression beta coefficients and significance levels).

Variable name	Variable description	(1) Standard model 2007	(2) 3-year average flow 2005–07	(3) Endogeneous stock lpdopp	(4) Interaction price × stock	(5) Standard model with sentiment	(6) Composition + Regional Spatial Strategy + sentiment	(7) 10 year panel 1998–2007
prrelprice_1/4	predicted relative price lag 1	0.074	0.081	0.080	0.395***	0.128	0.038	0.145***
pchgprlpric2	change in predicted relative price							0.121***
asunem	unemployment rate (%)	–0.172**	–0.199***	–0.312***	–0.294***	–0.369***	–0.190***	–0.160***
imdlinwc	Index of Multiple Deprivation low income (%)	0.232**	0.139*	0.257**	0.223**	0.224**	0.106	0.278***
pgreenw	greenspace (% of land)	0.203***	0.184***	0.142*	0.106	0.168**	0.070	0.365***
ddens	net dwelling density (dwellings/ha)							–0.004
lpdopp_1	log consents stock (% of households)	0.392***	0.582***					0.467***
prldpopp	predicted log consents stock			0.351***	0.642***	0.155**		
avsmstshare	small sites share of units	–0.170***	–0.219***	–0.322***	–0.301***	–0.346***		–0.226***
Pscmp	social rent completions	0.074***	0.058	0.130***	0.136***	0.126***		0.021
avgrantrate	applications approved (% average)	0.080	0.092**	0.021	0.094	–0.069		–0.090***
pgrant4ya	applications approved (4 year average)							
plav09	land available (% of households)	0.232***	0.182***	0.184***	0.183***	0.216***		–0.119***
pgreenbelt	Green Belt (% of land area)							–0.029*
decisweeks4ya	average decision time weeks						0.135***	0.063***
Pdl	previously developed land (%) units							
Prsstarg	Regional Spatial Strategy target (% of households)							
plgstance4	planning-stance composition						0.468***	
prmajdevm4	‘sentiment’ majority for development						0.255***	
prlprcxlpdopp	relative price × stock of consents				–0.449***	0.349***		
	Adjusted R ²	0.414	0.625	0.413	0.428	0.462	0.482	0.362
F		29.700	35.300	29.300	28.100	32.100	46.900	133.100
N		351	347	363	363	363	346	3024

*Significant at 10% level; **Significant at 5% level; ***significant at 1% level.

may be practical reasons for the positive association here, as well as the broader proxying of LA policy stance. For example, quite a lot of permissions result from reapplications for sites which have lapsed permissions, changes in ownership, or where the developer wishes to change the type and density of houses.

A related objection is that here we have a case of *endogeneity*—that certain key variables in the model are endogenous and so our estimation of their effects may be biased unless we allow for this. It has been suggested that two particular variables may be endogenous, house prices and the stock of consents. The standard technique for dealing with endogeneity is the two-stage least squares (or instrumental variables) approach, whereby the relevant variables are first predicted in reduced-form equations which contain all the exogenous variables in the system. In fact, we are already treating house prices in this fashion in our standard model, using predicted relative price from the reduced form. It is possible to test the further step of treating the stock of consents variable in the same fashion, by taking predicted values from the same reduced form. The results of this step are shown in model (3) in table 5. It can be seen that the resulting model is not very different from the standard one, with a similar effect associated with the stock of consents variable, stronger effects from small sites and social completions, and a smaller nonsignificant effect from success rate.

A further related argument is that it is the *interaction* of demand (through prices) and land availability that is crucial in driving the flow of consents and housing supply, associated with the view that the critical test of planning system performance is how it affects responsiveness of supply rather than level of supply (Hilber and Vermeulen, 2010). We test this proposition by introducing an interaction term between relative price and the stock of consents, as in model (4) in table 5. If this proposition were correct, we would expect the interaction term to have a significant positive effect in the model. In fact, the results shown in table 5 indicate a significant negative effect, implying that we should reject this hypothesis and stick with the simpler model. A further test, interacting price with the wider land availability measure (plav09) showed an insignificant negative effect.

It may be argued that our model may not reflect adequately the underlying local politics of planning, given the role of discretionary local decision making. We can test this by utilising a variable derived from parallel research reported in Bramley (2012b) which links survey data on public attitudes to local housing development to local characteristics including voting behaviour. We label the variable derived from this work ‘sentiment’; it essentially measures the predicted majority for or against more housing development under certain assumptions. Model (5) in table 5 adds this variable to model (3). It shows that this does increase the explanatory power somewhat, as we would expect. It somewhat weakens (displaces) the effect of the stock of consents variable, although this remains significant, while leaving other effects in the model relatively unchanged. Therefore we would conclude that, while this adds some explanatory power, it does not invalidate the general approach to constructing an index of planning stance from hard data on aspects of the local planning situation. We would expect the sentiment variable to play a stronger role following the 2010 changes in the planning system, with their greater emphasis on local decisions.

In the period up to 2009 the RSS *targets* were seen as playing a greater role. Should these be included explicitly in a model for this period? They are reflected indirectly through the broader land availability indicator (plav09), given the expectation on authorities that they should ensure an adequate five-year supply against this target. However, we can test the effect of direct inclusion of the RSS target in a modified model, as illustrated in model (6) in table 5. Here, the five components of planning stance from the standard model are combined in a composite measure, using weights from model (1), and this is included alongside the RSS target and the sentiment variable. The resulting model shows a further modest increase

in explanatory power, and the RSS target has a significant effect, although its magnitude is a lot smaller than the planning stance composite. We would conclude that our local planning stance composite is a robust measure which strongly affects the key outcome, and that RSS targets only modified this to some extent.

The final model (7) in table 5 is there to serve a different purpose: that is, to try to measure change over ten years using planning indicators which were actually time varying, as discussed further in section 6. It does, however, add something to the assessment of robustness by showing that consents stock and small sites continue to play a significant role. However, it poses further doubts about the success rate indicator, as its sign is negative in this model.

Overall, we would argue that these tests support the conclusion that our basic model is robust and that we are justified in using the resulting composite indicator of planning stance to characterise the operation of the system during this period.

4 Patterns of planning restriction

How do these actual measures vary across England, taking broad regions and types of locality defined primarily in terms of the urban–rural hierarchy?

Table 6 provides an analysis comparing six measures all scaled as indices centred on 1.0. The first measure is the proportion of greenspace or green land, which both represents position

Table 6. Relative index values for green land, Regional Spatial Strategy targets, planning stance, local sentiment, predicted and actual flows of consents by urban–rural category and broad region for 2007.

Broad region	Urban–rural category	Green land (%)	Regional target	Planning stance ^a	Predicted house price	Predicted flow consents	Actual flow of consents
breg	rurcat	pgreenw	prsstarg	plgstance4	prrelprice	prpppflow4	pppflow
North	urban	0.92	0.85	1.09	0.60	1.07	1.03
	some rural	1.17	0.93	1.05	0.70	1.08	1.05
	quite rural	1.50	0.80	0.85	0.83	1.06	0.82
	most rural	1.71	1.02	0.94	0.78	1.07	0.77
	total	1.05	0.87	1.06	0.65	1.07	1.02
Midlands	urban	0.72	0.81	0.98	0.66	0.98	0.87
	some rural	1.24	1.01	1.00	0.83	1.09	1.12
	quite rural	1.50	0.84	0.90	0.96	1.13	1.04
	most rural	1.66	0.68	0.86	1.06	1.15	0.97
	total	1.05	0.87	0.96	0.78	1.05	0.98
South	urban	0.72	0.99	0.99	1.07	0.92	0.94
	some rural	1.17	1.18	0.96	1.11	0.94	1.06
	quite rural	1.47	1.18	1.05	1.13	1.11	1.12
	most rural	1.66	1.73	1.73	1.03	1.82	2.48
	total	1.14	1.13	1.00	1.11	0.99	1.05
London	urban	0.48	1.12	0.95	1.52	0.83	0.87
	some rural	0.79	0.45	0.50	1.45	0.65	0.56
	total	0.49	1.10	0.93	1.52	0.82	0.86
England	urban	0.72	0.95	1.01	0.96	0.96	0.94
	some rural	1.17	1.05	0.98	0.94	1.00	1.06
	quite rural	1.48	1.06	0.99	1.06	1.11	1.08
	most rural	1.68	1.04	1.08	0.95	1.29	1.23
	total	1.00	1.00	1.00	0.97	1.00	1.00

^aPlanning stance is based on the regression model in table 3, using the last five variables.

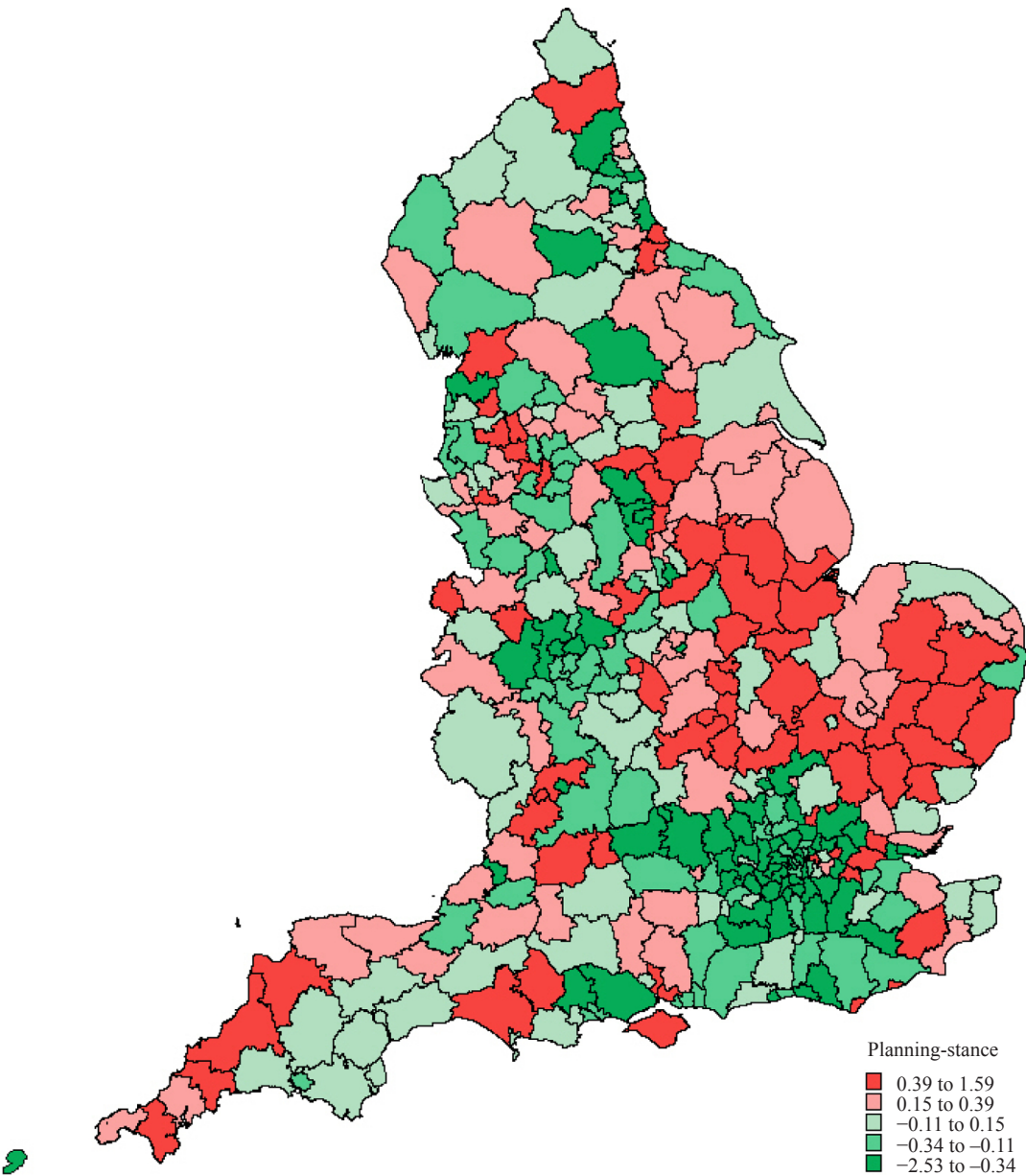


Figure 1. Planning stance in England, 2008.

on the urban–rural scale and measures land potentially available for housing development in the form of urban extension. The second measure is the RSS target operative in 2007. The third is our preferred composite measure of planning stance for that year. The fourth measure is relative house price level, capturing market demand pressure. The last two measures are predicted and actual flow of new permissions for that year. The table shows the analysis of these indicators for four groupings of authorities ranging from urban to most rural, within four broad regions.

Looking at table 6 we see that in the North consents tend to be above average in the urban and slightly rural areas but well below average in the more rural areas. This pattern is clearly influenced by planning stance more than by RSS targets, but perhaps reinforced by low prices especially in the more rural parts. In the Midlands, consents are low at the ends of the spectrum and a bit higher in the middle. This is driven partly by land availability but reinforced by targets and prices in the urban case and by targets and stance in the more rural cases. In the

South, consents are highest in the more rural parts and lowest in the most urban. This is driven by land availability but reinforced by targets and stance in the most rural case, and by targets in the intermediate cases. In London, consents are low, primarily because of lack of green land but reinforced by targets and stance in the 'some rural' category.

This account provides some insights into the way in which planning stances interact with objective constraints and land availability and with economic conditions to produce outcomes which deviate significantly from the pattern produced by the 'top-down' regional planning process.

Another way of looking at these indicators is to map them. Figure 1 shows patterns of our preferred composite measure of planning stance (*plgstance4*). The areas with more positive planning stances for new housing are a mixture of urban areas, particularly older industrial conurbations in the North and Midlands, and sparsely populated rural and agrarian regions which have 'more space', particularly parts of East Anglia, Lincolnshire, and the far South West, together with some designated growth areas (Ashford, Peterborough, Northampton). Areas with a more negative stance comprise a solid belt of London suburbs and surrounding areas (much of which contain Green Belt) extending to the south coast and westward to the Welsh border and into Dorset and Devon, with smaller blocks of negativity in 'more rural' and attractive parts of the Midlands and North.

5 Relationship with key need and outcome measures

Having derived these reasonably robust measures of the level of planning provision for (or restrictiveness over) new housebuilding for England in the period around 2007, what can we say about how these patterns relate to any operationalisable notions of the need for housing provision, or policy-relevant outcomes of the housing market? Clearly, following the Barker (2004) review and subsequent policy guidance (CLG, 2007a; NHPAU, 2008), house prices and the affordability of the market housing, conventionally measured by house price to income ratios, would be important relevant outcome or need indicators. A traditional benchmark for UK planning for housing is also demographic household growth, so we can also compare with this. Increasingly, local estimates of the need for 'affordable housing' are based in part on affordability as well as other factors including demographic and existing supply factors (see CLG, 2007b); we can compare with one such consistent measure applied to all LADs in England. Finally, planning has always also sought to support economic growth, and this receives even greater emphasis in recent policy guidance (DCLG, 2012)—a reasonable criterion here would be to see a relationship between housing provision and rates of workplace job growth over a recent period.

A simple way of assessing the adequacy or appropriateness of patterns of planning provision or restriction is to correlate our planning indicators with measures of these factors at LA level. Table 7 provides such a comparison. The planning policy indicators all take the form where higher positive values are associated with more provision of housing land or consents.

In general, with one exception, the planning indicators show a significant negative correlation with house prices, affordability, and net need for affordable housing. This is perhaps as expected in a system which is generally seen as relatively constrained and where planning constraint is believed to contribute to higher prices (Barker, 2004). The exception is the RSS target, which has insignificant positive coefficients. In summary, we can say that planning provision for housing bears little relationship to affordability but with some tendency towards a perverse relationship.

What about the traditional demographic criterion of 'need' or adequacy: that is, the projected growth in households? Here the correlations are at least positive, although they remain quite low in magnitude. This is consistent with a story that the planning system

Table 7. Correlations between planning indicators and house prices, affordability, housing need, household and job growth for 2007.

Planning variable	Description	Relative price <u>prrelprice</u>	House price to income ratio <u>hpir</u>	Household growth projection <u>hhprojgr</u>	Net need of affordable housing <u>nneedr</u>	Job growth Local Authority, 8 year plan <u>wjallgr9806</u>
pgreenw	Green land	-0.207	-0.152	0.116	-0.245	0.202
prstarg	Regional Spatial Strategy target	0.068	0.105	0.284	0.163	0.236
plgstance4	Planning stance	-0.196	-0.119	0.136	-0.070	0.160
prmajdevm4	Sentiment	-0.304	-0.081	0.016	-0.187	0.159
prpppflow4	Predicted consents	-0.304	-0.176	0.146	-0.175	0.208

Sources: planning indicators as table 1; house prices from Regulated Mortgage Survey (<http://www.cml.org.uk>) modelled local income estimates and net need for affordable housing from Bramley (2008); household growth from 2008-based Department of Communities and Local Government projections; job growth from Annual Business Inquiry data accessed by NOMIS database (<http://www.nomisweb.co.uk>).

Notes: correlations weighted by relative Local Authority size (number of households). Number of Local Authorities = 352. Correlation coefficients >0.11 or <-0.11 are significant at the 5% level.

(still) pays more attention to household projections than it does to affordability. The pattern for job growth is similar to that for household projections, but slightly more positive. All planning indicators have a positive relationship with recent job growth, but in no case does the correlation coefficient exceed 0.24. In the authors' experience (Bramley and Kirk, 2005) local authorities tend to be more keen to promote economic development than housing development, suggesting that there would be no automatic linkage from job growth to housing provision.

Clearly, these correlations only provide one type of evidence. They do not address questions of absolute adequacy of housing numbers, but focus on relative scores, and they are only a snapshot for one point in time. Nevertheless, they still provide a fairly compelling picture of a pattern of planning provision and stance towards housing which is not very helpful and not very well tuned to improving affordability, meeting need, or even supporting economic growth.

To fully inform the planning system of how far these local policy settings for housing supply would have to be changed in order to achieve given target levels of supply, affordability improvement, or need matching goes beyond the scope of this paper. This is the most analytically challenging aspect of the problem. It entails developing realistic, robust models which can quantify the relationships between planning inputs and housing-market outcomes and so solve the two problems of (a) attributing effects on outcomes to planning versus other causes (eg, economic and demographic factors), and (b) forecasting future outcomes conditional on assumed policies and background conditions. The skills and knowledge entailed in meeting this challenge go beyond those available to planning staff in LAs.

Several relevant economic models of the housing market in England have been developed over recent years. These include the official DCLG 'Affordability Model' developed by Meen and colleagues at Reading and other universities (Meen, 2011; Meen et al, 2008); past models developed by the present author (eg, Bramley and Leishman, 2005), including work on more subregional scale models. Bramley (2012a) provides a review, while earlier UK and US work were reviewed by White and Allmendinger (2003).

6 Changes in planning restriction

6.1 Changes since 1998

How far has planning restriction over new housing changed in England since the late 1990s? We cannot just map our preferred composite indicator of planning stance, as several of its components are not time varying. We can only offer a partial measure of change, based on those indicators which do change over time. Using a regression on the pooled panel of data for 1998–2007 [model (7) in table 5], we obtain predicted values as shown in table 8 (column 2), with changes since 1998 (column 4). Since differences in stance are measured in the same units as the flow of consents, we can express the changes as a percentage change on the average predicted value for this (column 3), with the resulting percentage shown in the final column.

The overall picture in this period is one of a shift towards a somewhat more positive stance towards new housing, equivalent to a 16% increase in the predicted flow of consents. In view of the major policy shifts of this period, including the Sustainable Communities Plan and the Barker (2004) Review and its aftermath (Bramley, 2007), it would be surprising if there had been no increase, and indeed this shift looks quite modest. Table 8 shows that there was a pronounced shift between the urban–rural typology, which operated differentially between the regions. In the North and Midlands there was a large increase in the urban areas, but a fall in the more rural areas. This may be interpreted as the implementation of the ‘urban renaissance’ (DETR, 1999) in a regional context where there was some recognition of potential problems of low demand or oversupply. In the South, stances became significantly

Table 8. Changes in planning stance from 1998 to 2007 based on modified composite indicator.

Broad region	Urban–rural category	Green land (%) pgreenw	Stance in 2007 plgstance5	Predicted flow of consents prppflow	Change of stance 1998–2007	% of predicted flow
North	urban	49.0	2.85	1.07	0.16	15.3
	some rural	62.1	2.78	1.08	0.03	2.4
	quite rural	79.5	2.57	1.06	−0.02	−2.2
	most rural	90.8	2.62	1.07	−0.17	−16.2
	total	55.8	2.80	1.07	0.10	9.5
Midlands	urban	38.1	2.81	0.98	0.23	23.0
	some rural	65.5	2.73	1.09	−0.06	−5.7
	quite rural	79.8	2.69	1.13	−0.12	−10.9
	most rural	88.1	2.55	1.15	−0.13	−10.9
	total	55.5	2.76	1.05	0.07	6.7
South	urban	37.9	2.86	0.92	0.24	25.8
	some rural	62.3	2.76	0.94	0.12	12.3
	quite rural	78.0	2.79	1.11	0.04	3.5
	most rural	87.8	2.97	1.82	0.22	12.0
	total	60.2	2.80	0.99	0.13	13.0
London	urban	25.6	2.88	0.83	0.52	63.3
	some rural	42.1	2.59	0.65	0.45	69.6
	total	26.3	2.87	0.82	0.52	63.6
England	urban	38.3	2.85	0.96	0.28	29.8
	some rural	62.3	2.76	1.00	0.06	6.4
	quite rural	78.5	2.74	1.11	0.00	−0.4
	most rural	89.0	2.67	1.29	−0.07	−5.2
	total	53.0	2.80	1.00	0.17	16.6

more positive in the urban areas, but only modestly more so in the slightly and very rural areas, while increasing little at all in the 'quite rural'. London saw the largest increase, in both subtypes of area. This was the strongest manifestation of the 'urban renaissance' tendency during this period.

6.2 Change in planning policy and 'localisation'

Since May 2010 Britain has had a new Conservative–Liberal Democrat coalition government, and this is bringing about a radical change in the approach to planning policy in England. The reform of the system was intended to place decision making firmly at the local and neighbourhood levels. For housing, this meant the rejection of 'top-down targets' for housing numbers and the complete dismantling of regional planning bodies, scrapping of RSSs, scrapping or curtailing of Regional Development Agencies, scrapping of a number of 'quangos' including NHPAU,⁽¹⁾ and withdrawal of some elements of existing national planning policy guidance. The new National Planning Policy Framework (DCLG, 2012) introduces a 'presumption in favour of sustainable development', but this is still intended to work through local development plans and the housing numbers they contain. Significant elements of this package involve the introduction or strengthening of various financial incentives to encourage local authorities to support new development, but assessment of these goes beyond the scope of this paper.

It is difficult to make a clear prediction as to how housing-land supply may change under this new regime, depending as it does on a number of factors including the extent of local responses to incentives and the way planning inspectors judge the soundness of local plans against evidence of need and demand. We would expect local sentiment towards housing development to play a greater role (Bramley, 2012b).

Some more limited inferences can be drawn from the evidence presented above about the differences between local planning stances and RSS targets, when these are expressed in the same units (flow of consents rate). The simple removal of RSS targets might then, as a first approximation, be expected to lead to a change in land supply equal to the difference between the RSS target (assuming it would have been complied with if the regime had remained unchanged) and the level of supply indicated by the local planning stance. We can report these numbers, but would acknowledge that this is likely to underestimate the overall impact of regime change. We find that increases in supply are more likely in the North (18% higher) and the Midlands (10%), particularly in the urban areas of those regions (24% and 17%, respectively). Reductions in supply are indicated in the South (13% overall), particularly in the 'some rural' and 'quite rural' category, and in parts of London. Key areas of pressure in southern England where more housing is most needed would be more likely to see reductions, and vice versa.

Confirmatory evidence that this is indeed the emerging pattern of change is provided by Tetlow King Planning (2012) in a study for the Policy Exchange which shows that revised local plan housing targets have reduced by 7.6% overall, with reductions of 6% in the East, 11% in the South East and West Midlands, and 22% in the South West, with modest increases in the North East, North West, and East Midlands (this study excludes London).

This evidence suggests quite strongly that the removal of RSSs and the localisation of planning decisions is likely to lead to a more perverse pattern of housing supply, with regard to the broader goals of tackling affordability and housing need problems, meeting household growth expectations, or supporting the growth of the economy, as reviewed briefly in section 4.

⁽¹⁾The NHPAU (National Housing and Planning Advice Unit) was set up in 2007 following the Barker (2004) review of housing supply, with a mission to improve the evidence base to support planning for affordability in the housing market.

7 Concluding discussion

There has been growing international interest in measuring planning regulation and modelling its effects on housing supply and affordability, but UK work on measurement of planning restraint has been quite limited, despite the long-established nature of the planning system and the recent upsurge of policy interest in housing supply. In this paper we revisited the issue, bringing together currently available measures from secondary sources and reviewing their adequacy, as well as describing patterns of restriction and recent changes in England. While we cannot claim that the analysis would necessarily fit other countries that have significantly different planning and regulatory systems, it may still provide pointers for those countries where local discretionary decisions are important in development control.

The main contribution of this paper is to develop and demonstrate the robustness of a composite measure of local planning stance towards new housing development. This exercise serves to underline that the most effective measures may not be those most readily chosen on a 'face value' basis or emphasised in recent literature. A further contribution is in describing the geographical pattern of planning stance and reinforcing the message that this is unhelpful in meeting the broader goals of alleviating affordability problems, meeting housing need, and broader growth goals. It is also shown that the predictable and actual outcome of recent planning reforms emphasising 'localisation' is to worsen this mismatch.

The most important of the available indicators of planning stance, judging by their effectiveness in predicting the flow of consents, are the stock of land with outstanding planning permission and the overall amount of land available within a five-year time horizon. Also important is the proportion of small site schemes (negative). Slightly more marginal indicators are the rate of social housing completions and the success rate of planning applications averaged over the whole study period, although the latter is clearly less robust. A number of other available indicators were shown to be not significant. Prediction of consents flow is further strengthened in this period by taking account of the amount of green land, the top-down RSS targets, and prodevelopment sentiment, as well as the planning stance composite derived above and market demand.

Inevitably, moving down the urban–rural hierarchy there is more land potentially available in terms of greenspace and undeveloped land, and discretionary policy stances interact with this and with market demand in determining actual supply. Planning stances tend to be more positive in urban areas in the North and the Midlands, while in the South there is a stronger positive tendency in the most rural districts furthest from London. The overall geographical pattern shows restrictive stances around London, particularly to the west, and in much of southern England, plus some attractive rural areas in the North, with a large block of more positive stances in the more rural, less urbanised, eastern part of England.

Correlation with key measures of the need for extra housing provision indicate that, in general, this pattern of planning stances and land provision is not helpful. There are negative correlations with affordability problems and related needs, weak correlations with household growth projections, and only slightly more positive correlations with employment growth. Positive stances in the urban North are of little value in the current climate where most such locations are economically unviable.

Unsurprisingly, in view of the national policy climate, planning stances became somewhat more positive in England over the period 1998–2007, although the extent of the change averaged only 16% in terms of predicted flow rate of new consents. There was a stronger positive shift in 'more urban' areas, with 'more rural' areas seeing either reductions or more-modest increases. These changes reflected the general emphasis of policy during this period in promoting 'urban renaissance'.

The current switch from top-down regional planning targets to ‘localised’ planning is likely, on the basis of simple comparisons, to lead to aspirational but unfulfilled increases in the North and Midlands and reductions in the South. These predicted patterns of change are being realised in practice, and are unhelpful and perverse from the viewpoint of addressing housing affordability and need, or facilitating economic growth.

These findings sound a warning about the likely outcome of recent planning reforms in England, with their emphasis on local decision making and the scrapping of regional targets. While understanding the attractions of a localist approach, the evidence that this is likely to lead to more perverse outcomes suggests that, at the very least, the system should be monitored more closely, and possibly that smarter and more targeted incentives should be employed.

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